

**Scientific Report**  
Jan. 2012– Oct. 2013

**New metal complexes with metal-chalcogen bonds - potential precursors for electronic materials. code PN-II-ID-PCE\_2011-3-0659**

**Objectives accomplished during the period Jan. 2012 – Oct. 2013**

- Design of new organophosphorus ligands with XPNSO skeleton. Synthesis and structural characterization.
- Design of new triorganophosphanes. Synthesis and structural characterization.
- Design of new organochalcogen (Se, Te)-ligands and their group 12 metal complexes; Synthesis, structural, characterization, thermal behavior.
- Metal complexes with organophosphorus ligands. Synthesis and structural characterization.
- Design of new organochalcogen (Se, Te)-ligands and their group 11 metal complexes.
- Organometallic group 12 and main group (Sb, Sn) metal complexes with organochalcogen (Se, Te)-ligands; Synthesis and structural characterization, thermal behavior.
- Design of new dialcoxo and carboxilato ligands and their *d* metal complexes; Synthesis and structural characterization.
- Design of new *d*-metal complexes with organophosphorus ligands with XPNSO and XPNPO skeleton. Synthesis and structural characterization.

Practically, in **2012** the followings steps were accomplished:

- Synthesis of unor hypervalent triarylphosphanes of type  $[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]_x\text{Ph}_{3-x}\text{P}$  ( $x = 0 - 3$ );
- Synthesis of new Cu(I), Cu(II) and respectively Co(II) complexes with triarylphosphanes, of type  $[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]_x\text{Ph}_{3-x}\text{PMCl}_y$  ( $M = \text{Cu}$ ,  $y = 1$ ;  $M = \text{Cu}$ ,  $\text{Co}$ ,  $y = 2$ )
- Synthesis of new Zn(II) and Cd(II) complexes with triarylphosphanes, of type  $[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]_x\text{Ph}_{3-x}\text{PMCl}_2$  ( $M = \text{Zn}$ ,  $\text{Cd}$ )
- Synthesis of new organophosphorus ligands of type  $[\{\text{XP}(\text{OEt})_2\}(\text{O}_2\text{SR})]\text{NH}$  [ $X = \text{O}$ ,  $R = \text{Me}$ ,  $\text{Ph}$ ,  $\text{C}_6\text{H}_4\text{CH}_3$ -4,  $X = \text{S}$ ,  $R = \text{C}_6\text{H}_4\text{Cl}$ -4].
- Synthesis of new palladium(II) and cobalt(II) metal complexes with anionic ligands of type  $[\{\text{XP}(\text{OEt})_2\}(\text{O}_2\text{SR})]\text{N}^-$  and  $[(\text{SPPH}_2)(\text{O}_2\text{SR})]\text{N}^-$ , respectively.

- Synthesis of the hypervalent  $[2,6-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_3]_2\text{Se}_2$  and the organoselenium halides of type  $[2,6-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_3]\text{SeX}$  ( $\text{X} = \text{Cl}, \text{Br}, \text{I}$ ).

- Sinteza unor noi liganzi din clasa 1-(2-((2-(3,5-dimethyl-4,5-dihidro-1H-pyrazol-1-yl)ethyl)selenyl)phenyl)-N,N-dialkylmetanamine (alkyl = Me, Et) and their reaction with  $\text{PdCl}_2$ .

- Preliminary studies concerning the synthesis of new ligands of type  $[\text{R}_2\text{C}(\text{OH})\text{CH}_2]_2\text{E}$  ( $\text{R} = \text{Me}, \text{Ph}$ ;  $\text{E} = \text{Se}, \text{Te}$ )

- All new compounds were characterized by multinuclear NMR ( $^1\text{H}$ ,  $^{13}\text{C}$ ,  $^{31}\text{P}$ ,  $^{77}\text{Se}$ , as appropriate) and mass spectrometry, and part of them by IR spectroscopy or single-crystal X-ray diffraction.

Majority of the reactions were performed under argon atmosphere, using dried and freshly distilled solvents.

In Table 1 are depicted the obtained compounds along with several analytical data.

**Table 1**

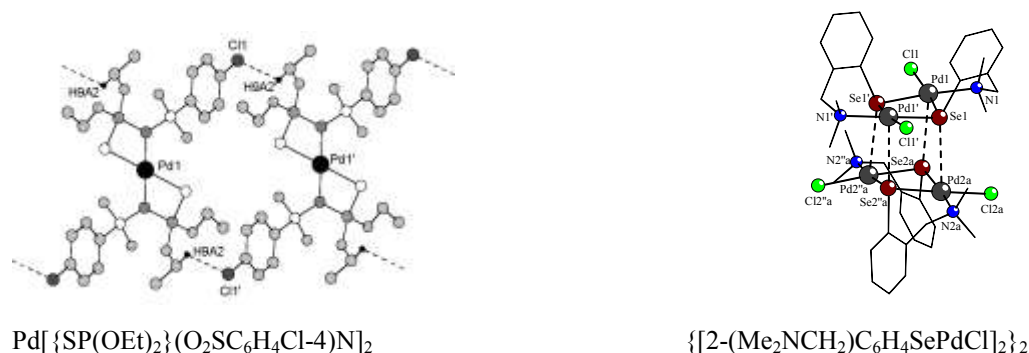
Nr.	Compound	m.p. °C	$\eta$ , %	Colour	$^{31}\text{P}/^{77}\text{Se}$ NMR [ppm]
1	$[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]\text{Ph}_2\text{PCuCl}$	255	49	yellow	-10.5
2	$[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]_2\text{PhPCuCl}$	181	quant.	yellow	-11.5
3	$[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]_3\text{PCuCl}$	194	quant.	yellow	-12.7
4	$[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]\text{Ph}_2\text{PCuI}$	182	quant.	yellow	-20,3
5	$[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]_2\text{PhPCuI}$	184	quant.	yellow	-27,6
6	$[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]_3\text{PCuI}$	189	quant.	yellow	-32,2
7	$[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]\text{Ph}_2\text{PCuCl}_2$	164	quant.	yellow	paramagnetic
8	$[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]_2\text{PhPCuCl}_2$	174	quant.	yellow	paramagnetic
9	$[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]_3\text{PCuCl}_2$	176	quant.	green	paramagnetic
10	$[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]\text{Ph}_2\text{PCoCl}_2$	241	quant.	blue	paramagnetic
11	$[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]_2\text{PhPCoCl}_2$	138	quant.	blue	paramagnetic
12	$[2-(\text{Me}_2\text{NCH}_2)\text{C}_6\text{H}_4]_3\text{PCoCl}_2$	198	quant.	blue	paramagnetic
13	$[\{\text{OP}(\text{OEt})_2\}(\text{O}_2\text{SMe})]\text{NH}$	93	78	colorless	-5.06
14	$[\{\text{OP}(\text{OEt})_2\}(\text{O}_2\text{SPh})]\text{NH}$	108	92	colorless	-5.40
15	$[\{\text{OP}(\text{OEt})_2\}(\text{O}_2\text{SC}_6\text{H}_4\text{CH}_3-4)]\text{NH}$	103	83	colorless	-5.28
16	$[\{\text{SP}(\text{OEt})_2\}(\text{O}_2\text{SC}_6\text{H}_4\text{Cl}-4)]\text{NH}$	142	85	colorless	57.26
17	$[\{\text{OP}(\text{OEt})_2\}(\text{O}_2\text{SMe})]\text{NK}$	69	quant.	colorless	-1.48
18	$[\{\text{OP}(\text{OEt})_2\}(\text{O}_2\text{SPh})]\text{NK}$	178	quant.	colorless	-3.17
19	$[\{\text{OP}(\text{OEt})_2\}(\text{O}_2\text{SC}_6\text{H}_4\text{CH}_3-4)]\text{NH}$	111	cant.	colorless	-2.31
20	$[\{\text{SP}(\text{OEt})_2\}(\text{O}_2\text{SC}_6\text{H}_4\text{Cl}-4)]\text{NK}$	164	quant.	colorless	54.75
21	$[\{\text{OP}(\text{OEt})_2\}(\text{O}_2\text{SMe})\text{N}]_2\text{Pd}$	202	76	orange	-1.93
22	$[\{\text{OP}(\text{OEt})_2\}(\text{O}_2\text{SPh})\text{N}]_2\text{Pd}$	oil	58	orange	-3.93

23	[{OP(OEt) <sub>2</sub> }(O <sub>2</sub> SC <sub>6</sub> H <sub>4</sub> CH <sub>3</sub> -4)N] <sub>2</sub> Pd	75	87	orange	-3.85
24	[{SP(OEt) <sub>2</sub> }(O <sub>2</sub> SC <sub>6</sub> H <sub>4</sub> Cl-4)N] <sub>2</sub> Pd	195	94	orange	57.77
25	[{SPPPh <sub>2</sub> }(O <sub>2</sub> SMe)N] <sub>2</sub> Co	194	82	blue	paramagnetic
26	[{SPPPh <sub>2</sub> }(O <sub>2</sub> SPh)N] <sub>2</sub> Co	87	75	violet	paramagnetic
27	[{SPPPh <sub>2</sub> }(O <sub>2</sub> SC <sub>6</sub> H <sub>4</sub> CH <sub>3</sub> -4)N] <sub>2</sub> Co	148	78	blue	paramagnetic
28	[{SP(OEt) <sub>2</sub> }(O <sub>2</sub> SC <sub>6</sub> H <sub>4</sub> Cl-4)N] <sub>2</sub> Co	154	87	blue	paramagnetic
29	[2,6-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>3</sub> ] <sub>2</sub> Se <sub>2</sub>	oil	80	orange	395.6
30	[2,6-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>3</sub> ] <sub>2</sub> SeCl	106	75	yellow	1202.0
31	[2,6-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>3</sub> ] <sub>2</sub> SeBr	143	83	orange	1211.5
32	[2,6-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>3</sub> ] <sub>2</sub> SeI	158	85	yellow	1214.3
33	[2-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>4</sub> ] <sub>2</sub> Se[CH <sub>2</sub> CH <sub>2</sub> (dmpz-3,5)]	43	73	yellow	243
34	[2-(Et <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>4</sub> ] <sub>2</sub> Se[CH <sub>2</sub> CH <sub>2</sub> (dmpz-3,5)]	ulei	60	yellow	247
35	[2-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>4</sub> ] <sub>2</sub> SePdCl	249	86	orange	-52.70
36	[Me <sub>2</sub> C(OH)CH <sub>2</sub> ] <sub>2</sub> Se	50	82	colorless	251.15
37	[Ph <sub>2</sub> C(OH)CH <sub>2</sub> ] <sub>2</sub> Se	63	78	colorless	51.6
38	[Me <sub>2</sub> C(OH)CH <sub>2</sub> ] <sub>2</sub> Te	45	83	colorless	-
39	[Me <sub>2</sub> C(OSiMe <sub>3</sub> )CH <sub>2</sub> ] <sub>2</sub> Se		74	yellowish	96

The new compounds were characterized by multinuclear NMR spectroscopy (<sup>1</sup>H, <sup>13</sup>C, <sup>77</sup>Se, <sup>31</sup>P, as appropriate). 2D NMR experiments (COSY, HSQC si HMBC) were used in order to assign the <sup>1</sup>H and <sup>13</sup>C resonances, while VT NMR was useful to investigate the dynamic behavior in solution for some species.

Mass spectrometry and IR spectroscopy were also used. For 14 compounds the crystal and molecular structure was determined by single crystal X-ray diffraction and the N→P, N→Se or N→M intramolecular coordination was evidenced. For several species intermolecular interactions were also observed, *i. e.* N⋯H in acids of type [{XP(OEt)<sub>2</sub>}(O<sub>2</sub>SR)]NH, O⋯H in [Ph<sub>2</sub>C(OH)CH<sub>2</sub>]<sub>2</sub>Se or Cl⋯H in Pd[{SP(OEt)<sub>2</sub>}(O<sub>2</sub>SC<sub>6</sub>H<sub>4</sub>Cl-4)N]<sub>2</sub>.

The molecular structures for two of the investigated compounds are depicted in Figure 1.



**Figure 1**

In **2013** the followings steps were accomplished:

- Synthesis of new organochalcogen (S, Se) ligands of type  $R_2E_2$  ( $E = S, Se$ ), with organic groups with pendant arms, capable for intramolecular coordination [ $R = C_6H_4C(Me)O$ ].
- The experiments used in order to obtain compounds of type  $C_6H_4C(Me)NR'(R' = benzyl)$  led to a cyclic compound, respectively 3-benzylamino-benzo[*b*]calchogenophen.
- Synthesis of monoalkoxo ligands of type  $[Me_2C(OH)CH_2]E[C_6H_4CH_2NMe_2]$  ( $E = S, Se$ ), by following original methods. Studies regarding the reaction between AgOTf and  $[Me_2C(OH)CH_2]S[C_6H_4CH_2NMe_2]$ .
- Synthesis of new complexes of Zn(II) and respectively Cd(II) with ligands of type  $[R_2C(OH)CH_2]_2E$ .
- New metal complexes of group 12 elements (Zn, Cd) with ligands of type  $[R_2C(OH)CH_2]_2E$  and triarylphosphanes of type  $[2-(Me_2NCH_2)C_6H_4]_xPh_{3-x}$ , respectively  $[ \{ (2-Me_2NCH_2C_6H_4)_xPh_{3-x}P \} M \{ E[CH_2C(OH)R_2]_2 \} ]$  ( $M = Zn, Cd$ )
- Synthesis and structural characterization of some precursors of Sb(III) and Bi(III), which would be used in the experiments envisaged for 2014. Studies regarding their behavior towards pseudohalides.
- Finalizing the studies related to the structural characterization and the redox behavior of some Cu(I) and Cu(II) complexes with triarylphosphanes obtained in 2012.
- Finalizing the studies related to the structural characterization and the redox behavior of Co(II) complexes with cu organophosphorus ligands of type  $[(XPR_2)(O_2SR')]N^-$ .
- Experimental and theoretical studies related to the structural characterization of ionic species containing the hypervalent cation  $[2,6-(Me_2NCH_2)C_6H_3]Se^+$ .
- The new compounds were characterized by multinuclear NMR ( $^1H$ ,  $^{13}C$ ,  $^{31}P$ ,  $^{77}Se$ , as appropriate) and mass spectrometry, and part of them by IR spectroscopy or single-crystal X-ray diffraction.

In Table 2 are mentioned the obtained compounds along with the used spectroscopic methods.

**Table 2**

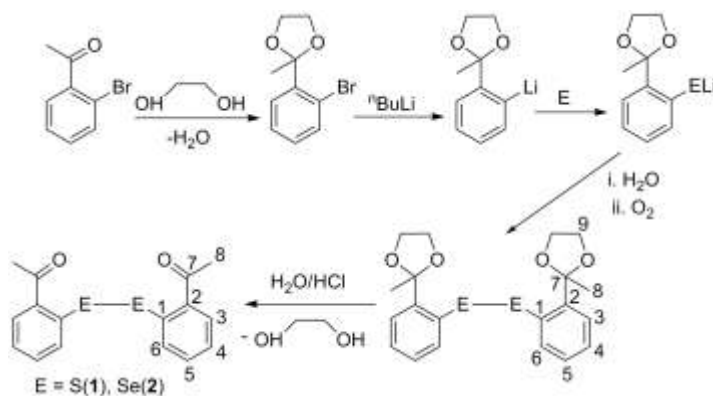
Nr.	Compound	m.p. °C	$\eta$ , %	$^{31}P/^{77}Se$ / NMR [ppm]	Spectroscopic methods
1	$[2-OC(Me)C_6H_4S]_2$	164	81,2	-	NMR, IR, X-ray
2	$[2-OC(Me)C_6H_4Se]_2$	187	79,4	488,4	NMR, IR, X-ray
3	3-benzylamino-benzo[ <i>b</i> ]thiophen	liquid	48,1	-	NMR, MS
4	3-benzylamino-benzo[ <i>b</i> ]selenophen	liquid	46	441.1	NMR, MS
5	$[Me_2C(OH)CH_2]S[C_6H_4CH_2NMe_2]$	liquid	48,3	-	NMR

6	[Me <sub>2</sub> C(OH)CH <sub>2</sub> ]Se[C <sub>6</sub> H <sub>4</sub> CH <sub>2</sub> NMe <sub>2</sub> ]	liquid	71,2	191,81	NMR
7	[Cd{S[CH <sub>2</sub> C(O)Me <sub>2</sub> ] <sub>2</sub> }]	172	56	-	NMR
8	[Cd{Se[CH <sub>2</sub> C(O)Me <sub>2</sub> ] <sub>2</sub> }]	194	35,5	Not observed	NMR
9	[Cd{Se(CH <sub>2</sub> C(O)Me <sub>2</sub> ) <sub>2</sub> } {PPh(C <sub>6</sub> H <sub>4</sub> CH <sub>2</sub> NMe <sub>2</sub> -2) <sub>2</sub> }]	165	33,7	-22,93 (P) 35,22 (Se)	NMR, MS
10	[Cd{Se(CH <sub>2</sub> C(O)Me <sub>2</sub> ) <sub>2</sub> } {PPh <sub>2</sub> (C <sub>6</sub> H <sub>4</sub> CH <sub>2</sub> NMe <sub>2</sub> -2)}]	225	33,3	-14,97 (P) 43,34 (Se)	NMR, MS
11	[Zn{Se(CH <sub>2</sub> C(O)Me <sub>2</sub> ) <sub>2</sub> } {PPh <sub>2</sub> (C <sub>6</sub> H <sub>4</sub> CH <sub>2</sub> NMe <sub>2</sub> -2)}]	176	30	-23,60 (P) 48,54 (Se)	NMR, MS
12	[AgOTf{S[CH <sub>2</sub> C(OH)Me <sub>2</sub> (C <sub>6</sub> H <sub>4</sub> CH <sub>2</sub> NMe <sub>2</sub> -2)]	118	51	-	NMR, MS, X-ray
13	[2-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>4</sub> ]Sb(SCN) <sub>2</sub>	160	85	-	NMR, MS,IR, X-ray
16	[2-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>4</sub> ] <sub>2</sub> Sb(SeCN)	96	71	Not observed	NMR, MS,IR, X
17	[2-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>4</sub> ] <sub>2</sub> Sb(NCS)	158	67	-	NMR, MS,IR, X
18	[2-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>4</sub> ]Sb(SeCN) <sub>2</sub>	131	65	mixture	NMR, MS,IR
19	[2-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>4</sub> ] <sub>2</sub> Bi(SeCN)	168	81	Not observed	NMR, MS,IR
20	[2-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>4</sub> ]Bi(SCN) <sub>2</sub>	125	62	-	NMR, MS,IR
21	[2-(Me <sub>2</sub> NCH <sub>2</sub> )C <sub>6</sub> H <sub>4</sub> ]Bi(SeCN) <sub>2</sub>	110	83	Not observed	NMR, MS,IR
22	[Cu({SP(OEt) <sub>2</sub> }(O <sub>2</sub> SC <sub>6</sub> H <sub>4</sub> Cl-4)N)]	199	72	45,1	NMR, MS,IR
23	[Cu(PPh <sub>3</sub> ) <sub>2</sub> ({SP(OEt) <sub>2</sub> }(O <sub>2</sub> SC <sub>6</sub> H <sub>4</sub> Cl-4)N)]	162	59	-4,52; 48,06	NMR, MS,IR, X-ray
24	[Cu{PPh <sub>2</sub> (C <sub>6</sub> H <sub>4</sub> CH <sub>2</sub> NMe <sub>2</sub> -2)} {SP(OEt) <sub>2</sub> }(O <sub>2</sub> SC <sub>6</sub> H <sub>4</sub> Cl-4)N)]	143	64	-21,2; 45,22	NMR, MS,IR
25	[Cu{PPh <sub>2</sub> (C <sub>6</sub> H <sub>4</sub> CH <sub>2</sub> NMe <sub>2</sub> -2)} {SP(OEt) <sub>2</sub> }(OPPh <sub>2</sub> N)]	128	79	-23,7; 43,14; 22,21	NMR, MS,IR

In 2013 the studies for a series of compounds were completed, respectively: (i) for several Co(II) complexes with organophosphorus ligands of type [{XPPH<sub>2</sub>}(O<sub>2</sub>SR')N]<sub>2</sub>Co cyclic voltametry studies were performed in order to see their redox behavior, (ii) for Cu(II) complexes with triarylphosphanes of type [2-(Me<sub>2</sub>NCH<sub>2</sub>)C<sub>6</sub>H<sub>4</sub>]<sub>x</sub>Ph<sub>3-x</sub>P was evidenced their reduction to Cu(I). The molecular structure of [{(2-Me<sub>2</sub>NCH<sub>2</sub>C<sub>6</sub>H<sub>4</sub>)<sub>2</sub>PhP}CuCl], obtained by the reduction of [{(2-Me<sub>2</sub>NCH<sub>2</sub>C<sub>6</sub>H<sub>4</sub>)<sub>2</sub>PhP}CuCl<sub>2</sub>] in the presence of triarylphosphane, was determined; (iii) some additional data for the ionic species with [2,6-(Me<sub>2</sub>NCH<sub>2</sub>)C<sub>6</sub>H<sub>3</sub>]Se<sup>+</sup> cations were obtained by DFT calculations.

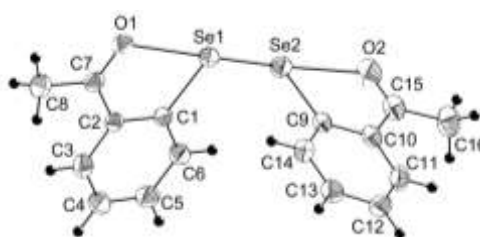
Different spectroscopic methods were used for the structural investigation of the new species: NMR, ESI or APCI MS, IR spectroscopy. For seven compounds the crystal and molecular structure was determined by single-crystal X-ray diffraction. For the Zn(II) and Cd(II) complexes [M{PPh<sub>2</sub>(C<sub>6</sub>H<sub>4</sub>CH<sub>2</sub>NMe<sub>2</sub>-2)}] (M = Zn, Cd) and [Cd{PPh(C<sub>6</sub>H<sub>4</sub>CH<sub>2</sub>NMe<sub>2</sub>-2)<sub>2</sub>}] (**9** – **11** in Table 2), the NMR spectra suggested a dynamic behavior in solution.

The diorganodiselenides **1** and **2** were prepared according to Scheme 1. The attempts to transform them in compounds of type Se<sub>2</sub>[C<sub>6</sub>H<sub>4</sub>C(Me)NBn]<sub>2</sub> led to the cyclic 3-benzylamino-benzo[*b*]chalcogenophens **3** and **4**.



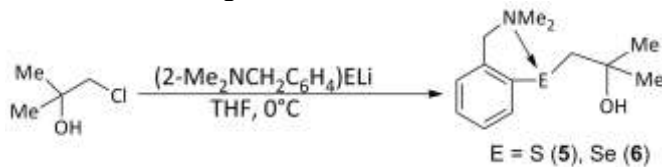
**Scheme 1.**

The molecular structure of compound **2**, revealed the intramolecular coordination of oxygen to selenium (Figure 2).



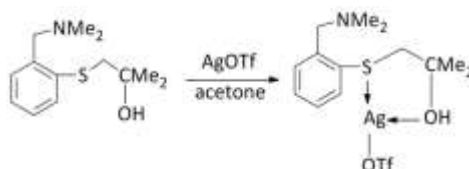
**Figure 2.**

The ligands **5** and **6** were obtained according to Scheme 2:

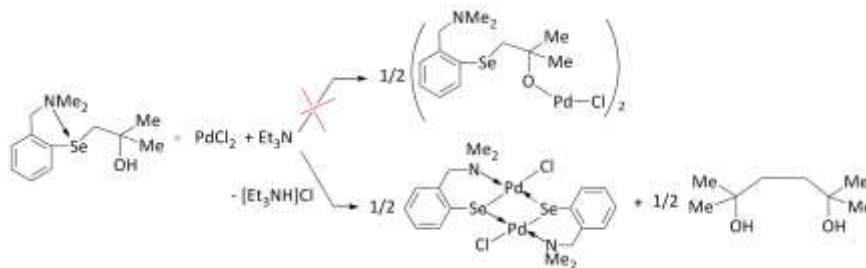


**Scheme 2**

Ligand **5** was used in reaction with AgOTf, as depicted in Scheme 3. The reaction between PdCl<sub>2</sub> with ligands of type RR'Se (**6** in Table 2 and respectively **33** in Table 1) led to the species [2-(Me<sub>2</sub>NCH<sub>2</sub>)C<sub>6</sub>H<sub>4</sub>]SePdCl (Scheme 4)



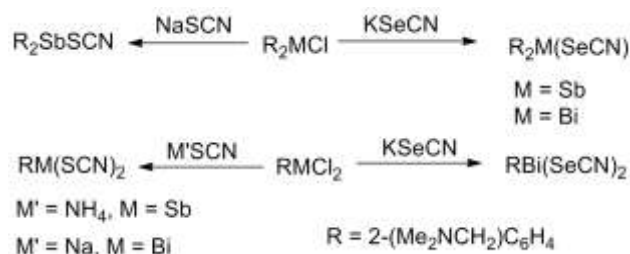
**Scheme 3**



**Scheme 4**

The X-ray diffraction studies revealed the formation of dimeric associations in the silver compound **12** (Figure 3), in which the ligand **5** is bridging the two silver atoms, in a *N,S,O*-bimetallic tetraconnective behavior.

**Figure 3.**



For several of the obtained pseudo-halides the molecular structure was determined by single-crystal X-ray diffraction, and the intramolecular coordination of nitrogen was evidenced, thus leading to hypervalent *12-M-5* species with a distorted square pyramid coordination geometry for compounds **16**, **17** and **19**, while for compound **13** de trigonal pyramidal coordination geometry (*10-Sb-4*) was established. For the compounds  $R_2Sb(NCS)$  and  $R_2M(SeCN)$  ( $M = Sb, Bi$ ) intermolecular associations by  $\pi(H \cdots Ph_{\text{centroid}})$  interactions were evidenced (Figure 4).

### Figure 4



## RESULTS

### Published papers, results obtained in 2012

1. New diorganoselenium(II) compounds and their behavior towards late transition metals.  
Alexandra Pop, Dragos Rosca, Raluca Mitea, Anca Silvestru, *Inorg. Chim. Acta*, **2013**, 405, 235-242.  
DOI: 10.1016/j.ica.2013.06.003.
2. Organophosphorus ligands with XPNSO skeleton (X = O, S) and their Pd(II) complexes. Crystal and molecular structure of [(EtO)<sub>2</sub>P(S)NSO<sub>2</sub>R]H [R = Me, C<sub>6</sub>H<sub>4</sub>CH<sub>3</sub>-4, C<sub>6</sub>H<sub>4</sub>Cl-4 and [Pd{(SPPH<sub>2</sub>)(O<sub>2</sub>SC<sub>6</sub>H<sub>4</sub>Cl-4)N<sub>3</sub>}<sub>2</sub>].  
Dorel Oltean, Alpar Pöllnitz, Anca Silvestru, *Polyhedron*, **2013**, 53, 67-75, DOI 10.1016/j.poly.2013.01.023.
3. Cobalt(II) complexes with hypervalent triarylphosphanes  
Raluca Mitea, Ancuta Covaci, Cristian Silvestru and Anca Silvestru,  
*Rev. Roum. Chim.*, **2013**, 58(2-3), 265-273.

### Results obtained in 2012 and finalized in 2013

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### Conferences 2012 / 2013

1. Group 16 (Se, Te) hypervalent compounds. Synthesis, structural diversity, chemical reactivity.  
Anca Silvestru,  
*invited seminar to Technische Universität Chemnitz (Germany), Nov. 2012.*
2. Diorganochalcogen(II) species bearing alkoxo functionalities and their coordination behavior.  
Raluca Mitea, Anca Silvestru,  
*poster presentation at ICOMC 2012 (2 - 7 Sept., Lisabona).*
3. New diorganoselenium(II) ionic species.  
Alexandra Pop, Anca Silvestru, Cristian Silvestru,  
*poster presentation at ICOMC 2012 (2 - 7 Sept., Lisabona).*



4. Organoselenium and -tellurium hypervalent compounds. Synthesis, structural diversity, chemical reactivity.  
Anca Silvestru,  
*invited seminar to* Universite Rennes 1 (France), Apr. 2013.
5. Organoselenium hypervalent compounds. Structural diversity and chemical reactivity.  
Anca Silvestru,  
*invited conference to* University of Fribourg (Swiss), Sept. 2013.
6. Organometallic species - potential precursors for group 12 metal chalcogenides.  
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### Contributions to PhD thesis

1. Alexandra Pop, Studies on synthesis, structure and chemical reactivity of some new organo-chalcogen compounds.  
PhD thesis, 2012.
2. Dorel Oltean, Complecsi ai unor metale tranzitionale din blocul *d* cu potentiala activitate catalitica.  
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3. Raluca Mitea, Complecsi ai metalelor tranzitionale cu liganzi cu atomi donori din grupele 15 si/sau 16.  
PhD thesis, 2013.
4. Ana Maria Toma, Hypervalent compounds of group 15 metals (Sb, Bi) with metal - chalcogen bonds, precursors for nanomaterials.  
PhD thesis, defence planed in 2015.

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